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Architectural competitions and BIM

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Abstract

New technological and societal developments have entailed changes within the building sector; including building trades becoming academically based, and the introduction of new building materials, new concepts and ICT-based designs and communication, traditional methods and organizations are being put under pressure. Thus, the two central actors involved in architectural competitions, architects and building clients, are continually influenced by such developments, interpreting and adapting to changes according to their interests and horizons. During a project reviewing Nordic research literature on architectural competitions, a series of interviews was conducted with building clients as well as architects, focusing on the impact of the above-mentioned changes within the building sector on architectural competitions as an institution. In the interviews, ICT and not least BIM was a recurring theme that both parties saw as having a positive impact on competitions. But when looking closely into the answers, these revealed diverse understandings of how and why the impact of BIM on competitions could be said to be positive. The paper sheds light on the interaction between the actors (building clients, architects and client consultants) and the applied technologies (competition forms, ICT tools, directives) in architectural competitions in a theoretical actor-network perspective. The diverging understandings of the role of BIM are demonstrating one of many negotiations in progress in the network of architectural competitions. BIM is transformed from an inscription device visually representing the competition proposals to form an actant that challenges the very concept of architectural competition.

The objective of the paper is to contribute to the understanding of BIM used in the kind of network that an architectural competition constitutes, and thereby give professional actors a possibility to act on the basis of a wider understanding of interrelations mediated by BIM.

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1. Introduction

The architectural competition has traditionally been important to the construction industry and, as an institution in Denmark, an important place for innovation, where new and unexpected solutions are developed and new ideas tested. However, there is an uncertainty in the industry regarding the use of architectural competitions, including clients' difficulties in reading and comprehending the functionality and constructability of competition projects. This uncertainty has led to an increase in the requirements specification and more extensive competition programs, with the result that the space for innovation has narrowed and architects' time consumption rises. In a competitive environment architects prepare more material than demanded, thus further increasing resource consumption.

The uncertainty about the direction of the architectural competition formed the basis for a preliminary study of the status of the competitions in a Danish setting (Sørensen, Frandsen, Øien, 2014). Containing a literature review and a series of interviews, the study has sought to establish an overview of existing research on architectural competitions, nationally and internationally, focusing on the period from 1990 to present. The series of semi-structured interviews was conducted with six of the key players in the field, including representatives from the Danish trade organizations of architects and building clients. Excerpts from the interviews presented in this text are "italicized".

Information and Communications Technology (ICT) was a recurring theme for the interviews and revealed different conceptions of what Building Information Model (BIM) can impart in competitions. The findings might also reflect differences in the opinion towards the role of architectural competitions as an institution. As an extension of these findings the objective of the paper is to study the use and the role of BIM in the network constituted in architectural competitions.

2. Architect competition in an ANT perspective

In this paper, we will try to map the network of the architectural competition and its actors, focusing on BIM with a point of departure in actor network theory (ANT). The theory includes both human and non-human actants and the term actant is preferred to stress that both subjects and objects form part of the network to be examined (Callon 1991; Latour 1996). The objective is to describe and analyse how a network between heterogeneous actants is constituted and unfolded. Networks move towards convergence or divergence between its actants and the links that are circulating between them are essential for the formation and growth of the network (Stalder, 1997). The network is optimized through coordination and convergence - the more coordinated and convergent the various actants, the more stable the network. Is the network stabilized, it forms a black box, a sealed network of people and objects, where only the input and the output are processed. If the actants on the other hand is diverging, the network will finally break down. Even though the actants of a network are described 'symmetrically', it is not necessarily an un-hierarchal relation. Implicit and explicit power relations exist because of technology and relations between persons and resources, and technology can be a medium to establish, maintain and negotiate power.

The analytical strategy of ANT is to follow the process of translations. Translation is a mediation, a communication process where a message is passing between different points and each translation can be seen as a distortion that transforms the entity. Callon (Callon, 1986) describes the translation process in four phases from *problematization* where a passage point is established in a network (new or existing), to *interessement* where the identity of the other actants are imposed, followed by *enrolling* a group of multilateral negotiations and finally *mobilizing* entities so they are representatives and support in the negotiations. An inscription is the result of a translation of one's interest into material form (Callon, 1991), such as practices, arrangements, documents and representations. Inscriptions can be communicated in the network and have a significant role in the process of negotiation, enrolling and mobilizing. The focus in the presented studies lies on processes and relations of the actants and how these constitute the network, giving some actants a particular status over others (Fuglsang, 2004).

2.1. Architectural competitions – elements of the network

Since the old Greece, architectural competitions have been a tool for tendering assignments for new buildings and

giving the building client a possibility to view different proposals and choose the best. The modern European architectural competition evolved as part of the growth of society in the 19th century, with economic growth and the increasing power of the bourgeoisie (Kazemian et al., 2005). Both building clients and architects have seen architectural competitions as public and democratic processes. Likewise, in Scandinavia architectural competition is a century-old institution and regarded as an efficient and reliable tool for innovation and dialogue (Rönn, 2011).

An architectural competition consists of several parties: the building client, the participating architects and other consultants, and the competition secretary. It is the building client that invites architects to participate. Within the last 15-20 years, the building client has increasingly been supported by a client design adviser, who gives advice on how to manage and procure the building project and identifies and documents the needs and requests as to the coming building. The proposing architects design their proposal based on the competition brief. In order to meet the many and varied requirements of the brief, the design proposals are made by a whole group of consultants, including architects, engineers and landscape architects etc.. The competition secretary gives advice about the competition form and is the one responsible for formalities of the competition, securing that the conditions are the same for all proposing architects and that the assessment of the proposals is consistent and fair.

The negotiations of the network of architectural competitions are stressed by Kreiner and Jacobsen (Kreiner og Jacobsen, 2013) as the relation of three basic elements: legitimacy, creativity and efficiency. Legitimacy refers to the methods that give every participant in the competition equal possibilities to win. The architectural competitions have been regulated by The European Services Directive from 1994, later replaced by procurement directives (EC, 2014). Projects of a certain amount are to be conducted after the directives and awarded after specific procedural rules. The European Commission (2013) has set the current threshold for public services to 998.019 DKR, and other services to 1.541.715 DKR. All tenders regardless of price are protected against discrimination. Another effort to present legitimacy is by securing anonymity so the building client and the jury do not know who is behind the various proposals. Likewise it is part of these efforts that all participants make their proposals based on the same information - the competition brief - and furthermore that the criteria for the assessment of the jury is known to them before they enter the competition.

The second element identified in the negotiations; creativity, refers to the room of innovation that the competition offers to the participating architects. The more detailed and specific descriptions and demands in the competition brief, the less different solutions are possible to generate and apply for the participants, reducing the solution frame and the room for innovation.

The third element, efficiency, refers to the resources applied by the building client, the participating architects and the surrounding society, compared to the size of the assignments. If the competition is open to all, the building client may receive many proposals and the processing of these proposals will be very resource demanding. Likewise, the demands as to the degree of detail and documentation of incoming proposals may be very high and thereby also resource demanding for the participating architects.

In every competition, the emphasis may be put differently on each of the three elements. Furthermore, the surrounding society, in the form of the organisation, technology and legislation of the construction industry, may have an impact on the weighing of the three elements.

2.2. BIM as a new actant

In construction, ICT is not limited to the understanding of the widespread office systems; except the focus is on the use of BIM, which gives promise of greater accuracy and transparency for the industry. The BIM models makes it possible to elucidate spatial or/and special architectural conditions and form the basis of renderings, so that a project may appear attractive in a competition. But these models will also provide opportunities for early economic calculations, for example by experience-based prices per square meter distributed on the model's function spaces. Where the first application does not require a particular precision, the second application does.

Architects have always been an important part of the development of the Danish construction industry, something which may be seen by looking at for example the participants in various R & D projects, such as the Board of users of IT (http://bips.dk/artikel/bestyrelse). The natural interest of architects to visualise future construction projects has helped to spread the idea of BIM among the industry's participants, that digitisation processes based on a model in line with technological developments will increasingly resemble reality. This realism is seen in models of geometry

of three dimensions. Unlike analogue geometry, digital geometry is interactive, and Virtual Reality, Walk-through, and Stereoscopy are all strong concepts that require 3D, and have contributed to expand the architect's array of tools, offering opportunities to better and faster visualise ideas than previously seen. In the perspective of ANT this process represent the phases of problematization, and interessement, where the passage point is established and other actants of the network imposed.

Eastman's view on BIM (Eastman et al. 2011), based on the NIB (National Building Information Modelling Standard) defines BIM as 'an improved planning, design, construction, operation, and maintenance process using a standardised machine-readable information model [..., which] contains all appropriate information created or gathered about that facility in a format […]'. In other words, a digital 3D model can deliver much more than a realistic image. It would lead too far to discuss all the topics, but it is sufficient to consider the automatic built-in information on geometric objects. An object does not only look like e.g. a floor, the applied polygon also has a length and a width - so it also has an area. Models that resemble reality can supply some information on this. Thus, a client would be tempted to ask whether the competition model, can supply information on the relative distribution of functions on the area. Subsequently, he would ask about the sum of the areas. All these issues are natural extensions of the use of competitions material. What seems realistic becomes real and there is a risk that it becomes more binding than the looser strokes of former architectural drawings. Competition principals adapted digitisation, as it promised realistic renderings of upcoming projects. But the lower levels of abstraction come at a price. A digital object oriented 3D model, performed without redundancy, properly classified, described and modelled, and whatever else expected of the well-executed model, can be used for all sorts of simulations and calculations. However, this can only occur to the extent that the required data is present. A BIM model without a special type of object cannot give the sum of the particular object type. The very existence of the two embedded options, located at opposite ends of abstraction scale, makes the actors perceive BIM as an actant and an active object, and is expressed in the fact that BIM gives us endless possibilities. As stated at the Danish center for productivity in construction *'Objects are independent of time and application'* (Feddersen, 2014) and thus indicate that the object supports the construction process from the very start to finish.

The enrolled actors have different interpretation of the role of BIM models in architectural competition, and the BIM model is therefore under negotiation. The question is, what does a competition require, and is the generated data of such a technical information level, that it can be expected to give the answers to further questions, and if so, which? But the question is also, whether the requirements and expectations towards BIM models represent an ongoing positioning between clients and architects, where BIM becomes an actant, with all its potential, moves the fundamental view of architectural competitions.

After the publication of the administrative order in 2006 (Erhvervs- og Byggestyrelsen, 2006), the Danish Enterprise and Construction Authority in 2007 published a number of guidelines concerning the use of BIM in the construction industry. The relationship between the client and the consultant was described in a guide (Erhvervs- og Byggestyrelsen, 2007) with 10 demands, where claims number 4a and 4b concern the use of building models in competitions.

Claim 4a: The client must assess whether use of the building model in idea and project competitions will contribute significantly to illuminate the proposal's architectural and technical qualities and, where appropriate, require the use of a building model.

Claim 4b: In competition conditions for contests the client must require submission of a **building model**. The client must specify the requirements for building the **content of the models** and **level of information** as well as the use of the model for **simulation**, **visualization**, etc. The requirements must cover at least the building's basic geometric shapes (volumes). The building model must be **object-based** and delivered in **IFC format**. If agreed, the parties involved can exchange data in a different format.

The highlighted words above were elaborated on in the administrative order. From claim 4a, the concept of 'assess' was explained as follows: 'The use of building models for visualization and simulation are very good tools to understand [...] the project. There is an important gap in the level of detail in building models from a simple volume model showing the physical dimensions to a building- or space model suitable for walk-through. The client must assess the use of the building model and the level of detail'.

The client only evaluates the use of a building model and its level of detail in the competition. In the guidelines, the building model is also explained as follows: 'The building model is a 3-dimensional digital representation of all

components of the project including surrounding terrain and buildings. To be a building model, it must include both geometric information and attribute information. Attribute information is e.g. windows, doors and surfaces. Today this building model, being called a BIM model, is defined and understood by being a mass of information that contains both drawing material [...] and description material' (Erhvervsministeriet, 2001, p. 21).

Thus, in 2006 and 2007, it was definite that the client required a BIM model in the competition, and that this model should be object-based, as stated in claim 4b. The claim for the object-oriented aspect is necessary in order for the model to be used in simulations, including the visual presentation. In the present guidelines (Byggestyrelsen, 2013), claim 6 deals with the use of digital building models in contests. The claim states that the client in the competition program must require that proposals include digital, object-based building models and visualizations performed on the basis of these. The building models and visualizations must document the proposal's architectural, functional and technical aspects at a certain level of information. It is also the client who, among other things, must ensure that the competition program requires structure and information content for the models (see further in § 4, which deals with information structure, classification, names, code and ID requirements for construction objects).

The situation today is unchanged compared to the claims of 2006. A minor change is that simulations do not appear as separate from visualizations. The client may still require the proposal's technical conditions at an unspecified level of information. Where the architectural documentation is likely to be implicit in a rendering performed on the 3D model, the proposal's functional relations is supposed to be somewhere in the object-oriented model, and finally, the proposal's technical conditions are expected to be presented in a range of property values attached to the simulation of relevant building objects.

The use of BIM in competition has thus been defined as a potential actant in the competitive network.

2.3. Towards divergence

The architectural competition has changed through times, both as an institution but also concerning the form and structure of it. The changes are affected by the ongoing negotiations between the current actors, and are also represented in the interviews. These negotiations include the direction and translations of different inscriptions such as the role of BIM, the competition program and the conception of the architectural competition.

The interviews showed a divergence in the comprehension of BIM and its impact on architectural competitions. Both building client and architects saw development of BIM as a potential. But while the building client saw a potential that had not yet been utilised sufficiently because of lacking skills within the group of building clients, the architects saw a potential of possible misuse of the time put into completions. The architects expressed that the resources concerning BIM are used inappropriately, not taking the purpose of architectural competitions into consideration*: "…it is silly that we use our most creative architects to draw the proposals as far as the detailed project in a BIM model, so they (the client) can measure the areas…"*,

And the interview reveals one of the architects doubts of the situation, as the informant continue: *"..because they do not. They choose the best proposal. "*

One of the building clients agreed that the resources put in BIM are not well used in architectural competitions: *" We had an experience gathering meeting after a competition, with all the participating consultants, the jury (…) Then someone wisely asked: 'those 3D models we made, did you use them and how did you use them?' And then the chairman of the jury asked: 'what 3D models?'"*

The building clients, however, see BIM as relevant in the architectural competitions, stating that there are merely some technical challenges, including the building clients' lack of some skills*: "At some point we will have a situation where these things come together, I guess. (…) When it becomes easier to render, then we will be able to assess better whether we are on the right track. And I guess that quantities and so on eventually will interact with it, but we are not there yet."* And further:

"The building client should focus on predicting the needs and demands of the future (…) and on what data will then be retrievable in the assessment of the proposals, e.g. room diagrams, room types and areas. Then it will be possible to get a picture of whether the proposals hit the target."

The negotiations also have included the role of the competition program. In the recent years, competition briefs have become more and more detailed regarding a range of elements, including visions, political values and technical requirements (Sørensen at al. 2014). These comprehensive programs are made from a desire to present the best

possible basis for the further process, but the programs can also be seen as inscriptions in the process of translation. Roles and requirements proposed in the program constitute the interessement to be negotiated and enrolled.

The trend of more and specific requirements to various properties of the building, as well as the increased requirements to the documentation, has been a central theme in all interviews. The architects query the tendency towards more specific requirements in competition briefs, seeing a risk of narrowing the solution space so much that the possibilities of the assignment will not be tried out.

"... architectural competitions are conducted with a lot of inadequacies.. If he (the building client) needs a fundamental concept and he then draws up a categorical and detailed brief with room diagrams on a detailed level and 3D BIM models, all the effort goes to this instead of uncovering his real needs".

Furthermore, this tendency is considered to be reflecting a wish of avoiding to incur responsibility: *"... there is a trend at the moment, not just within the construction industry, but everywhere there has to be documentation of all decisions and that leads to very high requirements for documentation (…) In brief, no one can be reproached for their choice, no one can incur a responsibility that they cannot vouch for, because the way it is handled means that no one has made a personal assessment".*

The building clients, on the other hand, state a need for certainty that the received proposals are buildable and have the demanded properties *"...regarding the following construction and technological adjustment, there is a need for a certain degree of certainty that it is possible to carry out (...) that someone can produce it".*

Furthermore, it is said that the increase in detailed demands and requirements of documentation is not only coming from building clients, but from architects themselves as a way of competing*: "A big change (…) is that the demands to the competition material have become much, much higher (…). More and more is submitted, and it is not only the building client who can be held responsible. The participants can be held responsible too, because they think they can improve their winning chances if they make a more beautiful rendering or put more effort into their calculation of energy consumption".*

As it appears from the citations above, there are different perspectives on the elements of architectural competition. Considering the tendency with Kreiner and Jacobsen's three elements in mind, the focus on legitimacy and efficiency, can be at the expense of the creativity. Furthermore, the conception of the architectural competition is also at stake. The competition unit at Danish architects' organisation lists 13 different types of competition and the mere amount of types indicates that the concept of architectural competition is not quite fixed. The many types of competition are not established as legal concepts, but exist only in the definitions offered by the architects' organisation (Kreiner et al., 2013). Local adaptions of existing types combined with new elements and conditions create a somewhat confusing palette of various architectural competitions. In the interviews, the development of architectural competitions, with the many and different competition forms, was described and understood quite differently by different actors in the network of competitions.

The Danish architects' organisation sees the variation of competition forms as an indication of the institution's vitality and importance: *"…there has been a notable development in the number of competition forms and there has been made experiments (…) I see it as an illustration of the good health and importance of competitions since there has been made so many experiments."* One building client, on the other hand, sees the many types as an unimportant differentiation: *"They are not that different, the 13 types (…) I gather that when they describe them as 13, it is because they are variations of the same."* The Danish Architects' organisation acknowledges that the architectural competition as an institution, as well as the architectural profession, is under pressure: *"The architectural competition as an institution has been under a pressure for many years and this pressure has in some way protected the way in which the institution was at a certain point, in order to save competition from disappearing. This confrontation has limited the possibilities for necessary development. So because we have been under this pressure, we now have an institution that has not developed."*

The spread of these statements indicates that the network of architectural competitions is moving towards a split-up, with the actants moving away from each other as a result of different views on the function of architectural competitions. To the various actors it is not evident what quality in competitions is, and they even less agree on the purpose of them.

3. Discussion: Towards convergence

In ANT perspective, BIM is a new-coming actant joining the network of the Danish architectural competition and, through its productivity-enhancing potential, an actant who challenges the stability of the network. This positioning can be seen in a sequence of several translations. BIM has been perceived differently by respectively the architects and the building clients. First included in the network as a visualisation technology by the architects, then adopted by building clients as a tool for calculating areas, time and costs. The negotiation of the role of BIM can be seen as a negotiation of power relations and a proportioning of the legitimacy, creativity and efficiency in architectural competitions.

BIM promise much, as simulations of any kind can support decision-making processes. The necessary data must be generated before a simulation can be implemented, and data must be structured so that the pairing of individual data is informative. The structured approach is difficult to imagine in a creative process in which the very composition of the data, the idea's basic components, is often diffuse. Without entering the discussion of whether the creative process can and should be based on evidence, it must be noted that it currently is not.

The impact of technology may be traced in many societal areas, and the several types of architectural competition can be seen as a reaction to a network put under pressure by technical development. In this context, technology is not a stand-alone product, but a tool promoting productivity in an existing network. Two comprehensible approaches to productivity would be 1) more products within the same time frame, or 2) higher product quality. For architects, quality is obtained by giving customers a better sense of the final product, through three-dimensional images, which may be seen as a better wrapping of the product. But the wrapping has come at a price, as clients seize the opportunity to pull out more information from the product. It is not possible for architects to provide this extra value, however, without compromising the product; therefore a countermove is made in the enlargement process of the many types of competition. No one regard this as particularly innovative. The desire for more information also expresses a focus on project effectiveness. Moreover, availability of measurable information supports the concept of justice. Since creativity is not in focus, nor a result of the digital process, the concept of creativity is applied only in a narrow sense.

The negotiations of BIM are, along with the negotiations of the competition program and the competition forms, demonstrating a network that is moving towards divergence. If the network of architectural competition is to resolve, the actants needs to mobilize and support the common good of the network. This may include a redefinition or translation of the concepts of architectural competition. The use of BIM in competitions must be incorporated and developed over time, but with the generally accepted low-abstraction-imagery, one must assume that realistic depictions will be part of competitions for a long time to come. At the moment there are no signs of a development of a specific level of abstract imagery that can communicate the idea without promising too much.

4. Conclusion

BIM technology may offer more than picture making, which previous tools from the architect’s tool box could not, because the BIM model and the embedded information are combined in a single format. In this sense, visual objects may contain all the information that cannot be drawn or modelled. An understanding of components that cannot be visualised, and that are important to process and communication in a competitive situation, is important for stabilizing the network. The latter will converge when the new actant is clearly defined and all members of the network know what to expect and consent to.

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